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Phase IIIa-CCS: Latitudinal variation of upwelling, retention, nutrient supply and freshwater effects in the California Current System

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US-GLOBEC NEP Phase IIIa-CCS: Latitudinal variation of upwelling, retention, nutrient supply and freshwater effects in the California Current System

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Project Summary

This proposal requests funding to: a) synthesize the moored current meter, shore-based HF radar, ship-based hydrographic, and remotely sensed data from the GLOBEC Northeast Pacific (NEP) Long-Term Observation Program (LTOP) and related programs into a coherent, best description of the mesoscale variability along the Pacific Northwest coast from 42 to 48�N; and b) relate this physical variability to primary production, zooplankton distributions, and salmon year-class strength in the region. The long-term moorings will allow quantification of the relevant time scales from internal waves to the inter-annual; the satellite images of sea surface temperature and chlorophyll will show the spatial scales; and the HF surface fields will allow time- and space-varying statistics of the mesoscale currents and quasi-Lagrangian pathways to be assessed. The primary scientific objective will be to characterize the alongshelf variability in the upwelling, the nutrients it supplies to the photic zone for utilization by marine organisms, and the retention times of plankton. This variability is affected by the alongshore distribution of the wind stress and fresh water input, by the changes in the bottom topography and coastline orientation, and by pre-conditioning established by inter-annual variability and climate change.

Intellectual Merit - Although the forcing of the California Current System (CCS) is very large scale (~several hundred kilometers; Hickey, 1989) the spatial patterns of surface chlorophyll and zooplankton distributions are much less spatially uniform. For example, significantly higher chlorophyll levels are found off Heceta Bank, La Perouse Bank, on the broad shelves north of the Columbia River and near the narrower shelves south of Cape Blanco (Thomas, 2004). For the first time on the U.S. West Coast, a suite of long term time series is available to study the sources of this variability. The observation sites include similar war depths at mid-shelf locations spanning over 700 km of coastline including both quasi two-dimensional and three-dimensional upwelling regions. The data will allow the biological concentrations at several trophic levels to be related to regions of both high variability / high gradients (such as the coastal upwelling jet) and low variability / high retention (such as Heceta Bank and south of Cape Blanco).

Broader Significance - The resulting synthesized data set will provide the best possible comparison point for the initialization and verification of both physical and ecosystem models being developed and tested by other GLOBEC investigators. The unified picture of the GLOBEC NEP region produced by both observations and models will be compared to the other GLOBEC sub-regions including Georges Bank in the Gulf of Maine and the Coastal Gulf of Alaska (CGOA), in order to understand fundamental differences in the functioning of marine ecosystems.

NSF Award Summary

None available.

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